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THE REFLECTIVE PEDAGOGICAL APPROACH IN MATHEMATICS LEARNING

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Absract

This paper aims to describe the reflective pedagogical approach in mathematics learning. It will discuss about the importance of reflection in learning, the models of reflective learning, and the steps of mathematics learning by using reflective pedagogical approach. Based on the results of theoretical studies, researchers define reflective pedagogical approach as a learning approach that emphasizes the importance of reflection in the learning process. The steps of learning mathematics by using reflective pedagogical approach includes experience (practice), reflection (reflection in practice), action (revised practice), evaluation, general reflection (reflection on practice).

Keywords: Reflective Pedagogical Approach, Mathematics Learning

Introduction

Today increasingly recognized the importance of promoting the active involvement of students in the learning process of mathematics. Students should be encouraged and given an opportunity to construct their own mathematical knowledge actively in math learning process. This approach will facilitate in-depth and meaningful learning for students, in addition to deeper understanding and mastery. The nature of learning - in constructivis' view - is a viable meaning-constructing process. Teachers can bring students to that stage through reflection.

Dewey (1910: 57) defines reflection as "*turning a topic over in various aspects and in various lights so that nothing significant about it shall be overlooked*". The definition of reflection is also conveyed by Tsang (Ghaye, 2011: 22). According to Tsang reflection is "*an intentional act of examining the rationale and justification of an action or belief*." Boud et al. (Brockbank & McGill, 2007: 36), defined reflection as "*a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciation*". Furthermore Brockbank & McGill (2007: 36) refer to the opinion Brookfield that "*the outcome of these activities is a change in assumptions about oneself and the world requiring a corresponding change in one's behavior and relationships"*.

Reflection in the learning process is important to both teachers and even more so for students. Reflective practice can help teachers become more sensitive to students' individual differences, and make them more aware of the impact of their teaching on the learning process. Reflective practice in the classroom can help teachers reflect on their decisions and consider changes that can improve learning for all their students (Eggen & Kauchak, 2012). Reflective practice can also help teachers adjust the teaching strategies and models that best meet the needs of students. Being engaged in reflective practice for students is a means to develop students' ability to monitor the progress of their own learning. Reflection also allows them to be engaged in a critical dialogue with themselves in everything which they think and do. Learning mathematics using a reflective approach is a valuable way to increase students' understanding and appreciation for mathematics.

Reflective Practice in Learning

The essence of the idea of reflective practice is a process of critical self-examination. The idea of reflective practice introduced by D.A. Schon in his famous book The Reflective Practitioner, published in 1983 (Eggen & Kauchak, 2012: 33). Associated with reflective practice, Check & McEntee (2003: xiii), reveal the following:

> *For us, reflective teaching is peeling back the layers of our own daily work, looking under the surface of our own teaching, making a conscious attempt to see our teaching selves as students see us, or as an observer in our classrooms would. It also means looking at the wider contexts that affect our teaching—issues of social justice, of schoolstructure, of leadership.*

Brockbank & McGill (2007: 36) define reflective learning as follows:

> *Reflective learning as an intentional social process, where context and experience are acknowledged, in which learners are active individuals, wholly present, engaging with others, open to challenge, and the outcome involves transformation as well as improvement for both individuals and their environment.*

According to McGregor & Cartwright (2007: 7) there are seven key characteristics of reflective practice (adapted from Pollard 2008: 14) that includes:

1) *having an active focus on the aims and consequences of your teaching*
2) *taking a cyclical approach to regularly monitoring, evaluating and revisiting your practice*
3) *using evidence to make judgments about success and how to progress*
4) *retaining open-mindedness, responsibility and wholeheartedness*
5) *basing developing pedagogy on insights from research as well as judgments from evaluating own practice*
6) *engaging with colleagues through collaboration and dialogue to improve professional learning and personal fulfillment*
7) *redeveloping practice by creatively integrating external frameworks and models of practice*

Reflective Learning Models

There are various models of reflective practice in learning. According to Rushton & Suter (2012: 12) basic model of reflective practice can be described as follows:

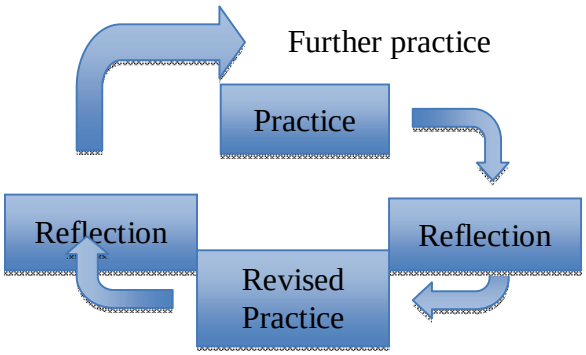

Figure 1. A basic model of reflection

The process starts with the professional practice of the teacher. The next stage is the reflection on what has gone on in the teaching and learning situation. This reflection may be an evaluation of teaching and learning, a consideration for example of whether the stated learning outcomes set for a session have been achieved, and if not why not. Reflection may however be prompted by a particular issue in the teaching and learning situation which needs to be resolved, perhaps problems with classroom management. At this stage the teacher will give consideration to how aspects of teaching and learning might be improved, or problems resolved. These reflections result in a revised practice, where the teacher makes the changes necessary to change and make improvements for teaching and learning. This is followed by another stage of reflection where the teacher will ask whether the changes they made to their professional practice had the desired effect.

Dewey's Model

Dewey states that there are five 'distinct steps' in reflection:

Step one : 'a felt difficulty'

Dewey notes that a 'difficulty' arises when there is a 'Conflict between conditions at hand and a desired and intended result, between an end and the means for reaching it'. This 'felt difficulty' can be readily contextualized in a teaching and learning situation. 'A desired and intended result' could be for instance the achievement of the stated learning outcomes for a learning session, or on an organizational level the setting up of a new course. 'Conditions at hand' might include the levels of motivation (or lack of it) of the learners, ability and attainment and the amount of time available for the learning.

Step two 'definition of the difficulty'

This is a crucial step according to Dewey; it makes the difference between 'reflection proper' and 'uncontrolled thinking'. Dewey warns that at this stage it is important to suspend judgment and not reach any hasty conclusions as to what is the cause of the difficulty. Any rushing to a conclusion will result in any suggestions for a resolution of the problem being merely 'random'. An example in a teaching and learning context might be where a teacher is experiencing difficulties with learners' behavior and concluding that it is because they lack motivation. To reach that conclusion at once, without considering other issues in the learning environment may result in the actual reason and therefore the possible solution to the difficulty being missed.

Step three 'suggestion'

Dewey states that synonyms for this word were 'conjecture' and 'hypothesis'. This is the stage where the various 'definitions' of the problem arrived at in step two are subject to more rigorous thought. Here the teacher gives consideration to a number of reasons for the problems with learner behavior – are they involved enough in the learning? Are there problems with learners understanding the content?

Step four 'Development by reasoning'

Through a process of careful thought some of the suggestions made at step three are dismissed. What is left is an idea or 'conjecture' which can be subject to what Dewey termed 'verification'.

Step five 'observation and experiment'

This is where the idea or conjecture arrived at the end of step four is subject to 'direct observation' or 'experiment'. A teacher who has given careful thought to problems of a lack of learner engagement might consider that the problem is learner passivity in her classes. This conjecture can be tested by introducing more active learning into her sessions to see if that provides a solution.

Schon's Model

One model which is highly influential reflective practice is a model developed by David A. Schon. Schon identifies that professional knowledge lies in doing the job. Many experienced teachers can not actually articulate what they know - they just do it alone. Schon argues that in this situation professionals use their knowledge and experience of the past as a framework for action - this is a form of 'knowing in action' (out of action) which comes from experience, and therefore different from Dewey's concept of routine action . Schon argues that if professionals can begin to separate the things that they know when doing these things, then they become more effective in their work. Part of this reframing involves setting and problem solving, interactive process in which we name the things we are going to present and frame the context in which we will bring these things. Schon proposes two types of reflection, namely: reflection-in-action (reflection is done when the action is still in progress) and reflection-on-action (reflection made after the action).

Reflection-in-action is an instant reflection that hardly realized that occurs when an experienced teacher solve a problem or dilemma. Schon describes this as repertoire drawing on their knowledge, skills and understanding of a situation so that he can change direction and operate differently in the classroom. In other words, rather than randomly try another approach, teachers use their accumulated knowledge and experience to look for alternatives in the

classroom in response to the needs of children.

Reflection-on-action takes place after the events or teaching sessions and a better consideration and process aware. There are more analytical and critical evaluation of the action and what might happen if a different course of action has taken place. Because this involves looking back at an event, it is a form of retrospective reflection. (Dymoke & Harrison, 2008: 10-11).

Brockbank & McGill (2007: 92) describe the model Schon in a hierarchy of levels, starting at the bottom with the action, at level 1 as following:

4 reflection on the description of the reflection-in-action
3 description of the reflection-in-action
2 reflection-in-action
1 action

Boud, Keogh and Walker's experiential model of reflection

Boud et al. state that the impetus to reflect may come about because of a 'loss of confidence' or 'disillusionment' in one's situation, though reflection might also be 'prompted' by more positive experiences, like successfully completing a difficult task. For Boud et al. reflection is a response to experience. There are therefore two parts to the model: first the experience itself and second the reflection which is based on that experience.

There are three stages in Boud et al.'s model, 'returning to experience', 'attending to feelings' and 'returning to experience'. In stage one there is a recollection of what took place, either that which has caused a 'loss of confidence' or more positively a recent success. Boud et al. note that as one begins to 'replay the experience' details start to emerge which were ignored at the time of the experience. It is only when we deliberately seek to reflect on our experiences that these details come to light. This deliberation also ensures that the reflection is based on 'real events' rather than 'what we wished had happened'. Boud et al. write of a 'stepping back' from experience; because one does not have to act or react to experience in 'real time', there is the opportunity to view the experience from a variety of perspectives, including that of others who were involved in the experience. At this stage the reflection should be 'clear of any judgements' as this may cause one to miss some features of the experience that were important.

Boud et al. named stage two 'attending to feelings'. Though they acknowledge that there are working in the tradition of Dewey, they state that they give much greater emphasis to the 'affective aspects of learning'. They place this emphasis on emotional feelings for two reasons. First they can become 'barriers to learning' – they can 'override our rationality'. The second reason is that 'positive feelings' can be used to provide us with the 'impetus to persist' in challenging situations. Reflecting upon positive experiences of success at a task can lead to the feelings of self- worth and confidence necessary to continue with a difficult task. Returning to feelings as 'barriers'. Boud et al. argue that they need to be 'discharged' or 'transformed' to enable one to respond effectively to a situation (p. 29) They suggest that this process may involve discussing the situation in a 'supportive environment' or through reflective writing.

The third and final stage is that of 're-evaluating the experience'. This in turn is split into four elements: 'association', 'integration', 'validation' and 'appropriation'. For Boud et al. 'association' is the linking of the ideas and feelings of both the original experience and reflection with existing knowledge and attitudes, the start of a learning process. They call this stage 'integration' because it is where new knowledge and feelings can be integrated into a 'new whole'. They suggest that this process can be aided by writing thoughts down and making connections between the new and existing knowledge and feelings. The next element is 'validation', where the knowledge and feelings we have started to integrate is subject to a 'reality test'. Here one is testing for consistency between the new and the old knowledge, and trying out the new knowledge in new situations. 'Appropriation' is the last element at this stage. This is where the new knowledge becomes so important to someone that it becomes part of their 'value system'.

Reflective Pedagogy at the Jesuit School

One of reflective learning that may already well known, in addition to models of reflective practice, as already discussed above, is developed based reflective learning paradigm Ignatian pedagogy in schools belonging to the Jesuits. Jesuit schools around the world emphasize the importance of reflection. Arguably, the reflection is at the heart of education for Jesuit schools.

There are five steps in learning with reflective pedagogical approach, which includes: context, experience, reflection, action, and evaluation.

(1) Context Learning

Human experience, which is the starting point in learning with reflective pedagogical approach, does not take place in a vacuum. It happened in a certain context. Therefore, teachers need to recognize as well the realities of contextual world's students and teachers. In this case, teachers need to recognize the good in the following context:

(a) The context of real-life students, which includes family, peer group, educational institutions and teaching, the social, political and economic conditions, the atmosphere of culture, media, music, and the realities of life that others close to student life. That's all the potential beneficial or detrimental impact on students.
(b) The context of the socio-economic-political-cultural environment which is very affecting learner students.
(c) The institutional context of the school or learning center, which comprises a complex network of norms, expectations, and interactions that characterize the atmosphere of school life. Various studies indicate that the atmosphere of the school is an absolute prerequisite for the continuity of a good education.
(d) The real context of learning processes, namely the notions that were taken by students when starting the learning process, the opinions and insights they gained from previous studies or from the environment they are learning context that must be considered. In addition, also the feelings, attitudes, and values them on the field of study they will learn the real context of their learning process.

(2) Experience

The experience is any activity which is characterized by cognitive understanding of the material and also listened to the affective dimension of student engagement. The experience can be divided into two, namely direct and indirect experience. Direct experience in ordinary learning situations take place through the experiences of interpersonal seems: discussion, research, fieldwork, social action, home stay, field trips, and so on. Indirect experience in the learning situation is an attempt to obtain information about an event through reading, listening or listening picture.

(3) Reflection

The term reflection here understood in the typical sense, namely an attempt listened attentively to the specific study materials, experiences, ideas, suggestions, or a spontaneous reaction in order to capture the deeper meaning. So reflection is a process that gave rise to meaning in human experience through means such as:

(a) better understand the truth of things he learned.
(b) understand the sources of feelings and reactions experienced by students when contemplating the experience.
(c) deepen student understanding of the implications for themselves and others.
(d) obtain a personal understanding of the events, ideas, truth or perversion of truth, and so on.
(e) understand themselves and how they should behave towards others.

The biggest challenge for a teacher is in terms of formulating the questions reflection. Lecturers need to avoid anything that is manipulation and indoctrination. Instead, teachers need to open a student sensitivity to human implications of what is being learned in such a manner, so as to overcome the previous experiences towards a more mature personal development. Where possible, it is better when shared reflection followed by a reflection (reflective dialogue).

(4) Action

The term refers to the action of the growth of the inner attitudes and actions are shown students

based on the experience that has been reflected. Thus, the action involves two steps:

(a) The options in mind. In reflection, students have considered the experience from the perspective of her (personal) and humane. Based on cognitive understanding and feelings that arise (both positive and negative) choices commitment. This can be in the form of option priorities within students.

(b) Option expressed outwardly. Meanings of life, attitudes, values, feelings obtained through reflection will encourage students to act.

(5) Evaluation

Reflective pedagogy is not only concern with the growth and academic development, but also the personal development of students and concern for others. Therefore, in addition to the evaluation of such a test, quiz or exam, it should be done that is comprehensive evaluation conducted at least once every quarter / semester. This evaluation primarily as a means to see the level of development. So the results need to be followed up with a reward and encouragement to further develop, for that is already well developed. On the other hand, for those who experience barriers to development, need to be followed up by pushing for further reflection. For example, by asking thoughtful questions, provide information needed, invites understand the problem with another point of view, and so forth.

Reflective Pedagogical Approaches in Mathematics Learning

Referring to the various models of reflective practice as well as reflective pedagogy applied in Jesuit schools, as already described above, we can define a reflective approach to pedagogy in mathematics learning an approach that emphasizes the importance of reflection in mathematics learning process comprising the steps of: experience (Practice), reflection (Reflection in Practice), action (Revised Practice), evaluation, general reflection (Reflection on Practice).

(1) Experience (Practice)

The experience is any activity which is characterized by cognitive understanding of the material and also listened to the affective dimension of student engagement. The experience can be divided into two, namely direct and indirect experience. At this stage, students can explore and use knowledge as a result of past learning experiences to help understand the concept / new teaching materials. Students identify, understand and formulate the problem of the event or events that presented the teacher. Students collect, organize and analyze the data to find a particular concept. Students draw conclusions, formulate rules, principles, ideas, generalizations or concepts based on the data obtained.

(2) Reflection (Reflection in Practice)

Reflection here understood as an attempt listened attentively to the specific study materials, experiences, ideas, suggestions, or a spontaneous reaction in order to capture the deeper meaning. Students reflect on the process of learning that has been experienced. Reflection can be related to difficulties experienced during the learning process and formulate clearly the difficulties, as well as in relation to efforts to overcome these difficulties.

(3) Action (Revised Practice)

The term refers to the action of the growth of the inner attitudes and actions are shown students based on the experience that has been reflected. At this stage, students undertake an improvement over the previous process is still lacking (incorrectly) using input from teachers, and other students. With a revised understanding of the students working / finishing / solve other problems.

(4) Evaluation (Evaluation)

Evaluation is done to check the students' understanding or mastery of teaching materials. Evaluation is a means to see the level of development experienced by students. At this stage, students work on a few questions to check for mastery of teaching materials.

(5) General Reflection (Reflection on Practice)

At this stage students perform general reflection after the learning process is completed. Looking back on what has been learned and make a summary of the important material that has been studied. Looking back any feelings dominant arose during the learning process. Explore

the meaning and find the values of the primacy of the learning process they experienced. At this stage, the teacher can provide confirmation of the process that has been experienced by students.

An Example : Implementation of Reflective Pedagogy in Learning Sequences and Series

At this stage of the experience, the teacher presents a picture of the activities of the line of march. Based on the pictures and the experience that previously mentioned, students observe the image, for example in a row students identify the boys and girls in different rows, high student was in front, and so forth. Then students are asked to formulate about understanding the line. From this understanding further the students are asked to formulate an understanding of the sequence of numbers.

At this stage of reflection, students look back rows and rows of the material that has been studied. Students look at any part of the material that he had difficulty. Students are then asked to formulate clearly the difficulties. After that the students shared his difficulties experienced, this can be done in a group or in classical. Teachers to involve other students who have mastered the material properly discuss the difficulties experienced by the majority of students and ensure that students are able to overcome these difficulties.

In the action stage, students understand the concept of sequence and series that is not well understood or rework the questions sequence and series that they previously had difficulty based explanation of the teacher or other students in the previous stage. Students also work on the problems that one type of sequence and series or about the development to further strengthen the students' mastery of concepts.

In the evaluation phase, students work on a few questions to evaluate mastery of concepts/ content sequence and series individually. After completion of work, such questions are discussed in the classical and students can correct their work and give notes on any part of the students still make mistakes.

In general reflection stage, students review the material sequence and series that have been studied and made a critical summary of the material. Furthermore, student reflection looking back experienced learning process, identify the dominant feeling anything appearing in the learning process and find the source of the dominant feeling. Students also explore the value and find meaning anything that can be gleaned from the learning process that has happened which is useful for further processing. After that, each student shares his reflections result. At the end of the teacher gives reassurance to all experience the learning sequence and series.

Conclusions and suggestions

The reflective pedagogical approach in mathematics learning is a learning approach that emphasizes the importance of reflection in the mathematics learning process which includes the steps of: practice, reflection in practice, revised practice, evaluation, and reflection on practice. This approach can be an alternative approach to the study of mathematics, so that the process of mathematics learning becomes meaningful for students. Stages in reflective pedagogical approach can help students understand and master the material/concepts in depth. In addition, the emphasis on reflection in this approach, allowing students to explore the values and find the meaning of her learning process.

Some advice for teachers who will implement a reflective approach to pedagogy in mathematics, among others: first, the teacher must carefully design the learning process, both from the aspect of teaching materials as well as time spent in the learning process. Teachers should plan the stages in reflective pedagogical approaches adapted to the teaching materials and learning time. Second, it takes consistency of teachers to perform the steps reflective approach to pedagogy in mathematics, because basically reflective pedagogical approach is a long-term investment, which is not at all directly so. Third, teachers also need to be open and have a willingness to also reflect and every time an evaluation and improvements to the dynamics of reflective pedagogy in mathematics to better function from time to time.

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